REMARKS

This is a supplemental response to the response filed on June 11th, 2007 in response to the notice of non-compliance. This supplemental response is meant to offer a more complete and persuasive response to address the issues raised by the examiner in the Office Action mailed on March 28, 2006. Please regard this response, and the claims that are in this response, as the valid response to the Office Action mailed on 3-28-06. In that Office Action claims 1-4, 7, 8, 11, 12, 16, 17, 19-22, 24-31, 34, 35, 39, 40, 43-49, 51, 79, 82, 83, 85, 86, and 91-93 were rejected. The claims have been amended to address the concerns raised by the Examiner.

Claims 1-118 were originally presented. Claims 5, 6, 9, 10, 13-15, 18, 23, 32, 33, 36-38, 41, 42, 50, 52-78, 80, 81, 84, 87-90, and 94-118 have been canceled without prejudice. Claims 1-4, 7, 8, 11, 12, 16, 17, 19-22, 24-31, 34, 35, 39, 40, 43-49, 51, 79, 82, 83, 85, 86, and 91-93 remain in the application. Claims 1, 19-22, 24, 34-35, 79, 82, 83, 85, 86, and 91-93 have been amended. No claims have been added.

Claim Rejections - 35 U.S.C. § 102

Claims 1, 3, 19, 21, 26-30, 79, 82, 83, 85, 86, 91, and 92 (including independent claims 1, 19, 79, and 91) were rejected under 35 U.S.C. § 102(b) as being anticipated by Tanaka et al. (4,823,908) (hereinafter Tanaka).

In order to most succinctly explain why the claims presented herein are allowable, Applicant will direct the following remarks primarily to the originally presented independent claims 1, 19, 79 and 91 with the understanding that once an independent claim is allowable, all claims depending therefrom are allowable.

Tanaka discloses a parametric loudspeaker configured to safeguard listeners from "powerful ultrasonic waves" using an acoustic filter. Tanaka discloses a parametric speaker that comprises 120 piezoelectric transducers 40 having a diameter of 9.7 mm. (See FIG. 5, Col. 7 lines 3-4). The plurality of transducers are packaged in a rectangular container. The plurality of piezoelectric bimorph transducers (referred to as a parametric array) together with the rectangular container are referred to as an ultrasonic wave radiator 8. (Col. 7, lines 1-9 and 39-41).

The parametric array "is enclosed by the baffle plate 13, the shield 12 and the acoustic filter 10 to avoid any possible leakage of ultrasonic waves to the outside." (Col. 7, lines 9-11). The shield is formed of 5 mm thick acryl. Several embodiments of the acoustic filter are disclosed. The embodiments include a soft polyurethane foam to absorb the ultrasonic waves and a polyethylene film sandwiched between layers of foam. (Col. 8, lines 10-13). Tanaka teaches that "when the soft polyurethane foam is used alone, the thickness necessary to accomplish a required amount of attenuation of the primary wave increases and the attenuation of the secondary wave also increases. In contrast thereto, when the plastic film is sandwiched, the thickness of the filter necessary to accomplish the same amount of attenuation of the primary wave may be reduced and the attenuation of the secondary wave may be decreased correspondingly." (Col. 8, lines 34-43).

In Contrast, independent claim 1, as amended, sets forth, in part:

> b) **transferring the electronic signal to an electro acoustical polymer film transducer** diaphragm which couples directly with the air as part of a single stage energy conversion process;
>
> c) converting the electronic signal at the diaphragm directly to mechanical displacement as a driver member of a parametric speaker; and
>
> d) mechanically emitting the at least two ultrasonic signals from the diaphragm into the air as ultrasonic compression waves which interact within the air to generate the parametric audio output.

Claim 1 has been amended to include the limitation that the transducer is a polymer film transducer. This amendment was made in view of the examiner's understanding that the term "film", as recited in claim 1, included any thin object, including piezoelectric ceramic transducers. The claimed embodiments of the present invention are not intended to include ceramic transducers. Rather, they are limited to polymer film transducers, as disclosed in the specification and shown in the corresponding figures. This is supported by the extensive discussion of the limitations of ceramic bimorph transducers in the background of the specification. The polymer film transducers are intended to overcome many of the limitations

created in the use of small ceramic transducers. Tanaka does not disclose the use of polymer film transducers.

Furthermore, the polymer film transducers are used to convert the electronic signal at the diaphragm directly to mechanical displacement, as recited in claim 1. Tanaka does not use polymer film transducers to convert an electronic signal to mechanical displacement. The only use of polymer films in Tanaka is to absorb acoustical energy as part of the acoustic filter.

Therefore, Applicant respectfully submits that independent claim 1 is allowable, and urges the Examiner to withdraw the rejection.

Independent claims 19, 79 and 91 have also been amended to include the limitation of a polymer film transducer. The same arguments above apply to these independent claims. Therefore, Applicant respectfully submits that independent claims 19, 79 and 91 are allowable, and urges the Examiner to withdraw the rejection.

Rejection of the dependent claims 3, 21, 26-30, 82, 83, 85, 86 and 92 should be reconsidered and withdrawn for at least the reasons given above with respect to the independent claims. The dependent claims, being narrower in scope, are allowable for at least the reasons for which the independent claims are allowable.

Claim Rejections - 35 U.S.C. § 103

Claims 2, 4, 11, 12, 20, 22, 34, 35, 46, 48, 49, and 51 (including independent claim 46) were rejected under 35 U.S.C. § 103 as being unpatentable over Tanaka in view of Schindel et al. (5,287,331) (hereinafter "Schindel").

There is no motivation to combine the electrostatic transducer of Schindel and the parametric loudspeaker of Tanaka. Prior to the present application, parametric speaker systems were constructed using an array of small, piezoelectric bimorph ceramic transducers. There are a number of positive attributes that lead those skilled in the art to use the bimorph transducers. The transducers are small and can be relatively energy efficient if they are used at their resonant frequency. The bimorph transducers are off the shelf components that are typically fairly high in power. The high power of the bimorph transducers can help to overcome the relatively large inefficiencies in the coupling of ultrasonic waves to air and demodulation of parametric waves to

produce audible sound. Therefore, the understanding in the art was that more power injected into the air in the sonic output would result in better quality sonic sound.

Those skilled in the art prior to the present invention sought to achieve better quality sonic output from a parametric speaker by using larger and larger arrays of high power bimorph ceramic transducers. For example, the parametric loudspeaker of Tanaka uses an array of 120 separate piezoelectric transducers arranged in a honeycomb pattern on a substrate. (Col. 7, lines 3-8). While Tanaka does not disclose the exact properties of the piezoelectric transducers, the limitations described in the specification, that each transducer has a 9.7 mm diameter, a center frequency (aka resonant frequency) of 40 kHz, and a sound pressure level of 123 dB, match the specifications of a ceramic bimorph transducer. Therefore, it is assumed that Tanaka uses an array of bimorph transducers. Later attempts to produce a commercially successful parametric loudspeaker included ever larger numbers of ceramic transducers (over 1000) to achieve a desired volume after the sonic signal was decoupled from the ultrasonic parametric waves output from the array.

The properties of polymer film transducers, such as the electrostatic transducer disclosed in the claims cited above, are substantially different from typical cone type speakers and ceramic transducers. For example, one important aspect of polymer film transducers in general and electrostatic transducers specifically, is that they typically are not capable of producing sonic or ultrasonic waves near the amplitude achieved with more traditional transducers, such as the piezoelectric ceramic bimorph transducers used in parametric sound systems at the time.

Schindel does not disclose the sound pressure level at which the electrostatic transducer can produce ultrasonic waves. However, US 4,246,448 to Tam et al. discloses an electrostatic transducer designed for use as a loudspeaker that is capable of producing a maximum sound pressure level of 105 dB. (See Tam, Column 8, lines 60-62). Thus, **the output of the electrostatic transducer loudspeaker is 18 dB (63 times) lower than *each* of the 120 transducers disclosed in Tanaka**. Therefore, one skilled in the art would be significantly dissuaded from combining the electrostatic transducer of Schindel in lieu of the array of transducers disclosed in Tanaka.

However, the inventors discovered significant, unexpected results by using polymer film transducers instead of an array of bimorph ceramic transducers. Despite the fact that polymer

film transducers can output dozens of times less power than an array of bimorph transducers, it was found that the polymer film transducer was capable of overcoming many of the obstacles that limited the commercial potential of parametric speaker systems.

Despite bimorph transducers many positive attributes, as previously discussed, the inventors found that bimorph transducers also had several drawbacks that contributed to the lack of marketability of parametric sound systems. For example, the ability of bimorph transducers to output very high power acoustic waves was considered favorable by those skilled in the art due to the need to output high power parametric waves to produce a decoupled sonic wave having sufficient power, as previously discussed. However, the inventors discovered that high drive intensity immediately in front of each bimorph device can readily drive the air into shock or saturation. This phenomenon breaks down the effective demodulation of the audio signal, causing loss of power output and severe distortion of the audio sound component, as well as other serious adverse effects upon the general process of parametric loudspeaker operation. In addition, bimorphs have poor frequency response and unwanted sub-harmonics.

While it has been perceived that increasing the number of bimorph emitters would provide increased ultrasonic output, it was discovered that the use of a large number of bimorph emitters merely exaggerates the problem of air saturation and serious power loss. Furthermore, the inventors have discovered a number of accompanying limitations with phase matching errors due to variations from device to device in the bimorph emitters, along with distortion and bandwidth problems and the associated cost and complexity of using so many separate devices. Indeed, it was discovered that the phase relationships of these separate devices are such that the total output of many devices used as a cluster does not add up to the amount predicted by just summing all the devices.

The use of polymer film diaphragms, such as the electrostatic transducer disclosed in the above recited claims, was found to unexpectedly overcome many of the limitations of an array of bimorph transducers. Specifically, the lower power but larger polymer film diaphragms typically do not have a problem with driving the air into distortion. This allows the sonic signal to demodulate from the ultrasonic carrier signal more effectively, with less distortion and loss. Additionally, even when a film diaphragm is divided into a plurality of sections, the sections can be more homogenous and more accurately controlled with respect to phase to allow the output of

the transducer to have better phase characteristics, creating an acoustic signal with better sound quality and more ability to control its directionality.

Thus, the use of a polymer film diaphragm in lieu of an array of bimorph transducers is in contrast to the teachings of Tanaka. The Tanaka and Schindel references teach away from each other. Tanaka discloses the use of a plurality of high power piezoelectric bimorph transducers. The inventor's use of film diaphragms went against the teachings of the art at the time of the invention. Rather than using devices that produce greater sound pressure levels, as disclosed in Tanaka, the inventors discovered that they can achieve better audio quality in parametric sound systems by using lower power polymer film diaphragms.

Therefore, Applicant respectfully submits that claims 2, 4, 11, 12, 20, 22, 34, 35, 46, 48, 49, and 51 are allowable, and urges the Examiner to withdraw the rejection.

Claims 4, 7, 8, 16, 17, 25, 31, 39, 40, 46, 48, 49 and 51 (including independent claim 46) were rejected under 35 U.S.C. § 103 as being unpatentable over Tanaka in view of Tibbetts et al. (4,056,742) (hereinafter "Tibbetts").

The above recited claims are rejected over Tanaka's disclosure of a parametric loudspeaker in view of Tibbetts teachings of a piezoelectric film that was thermally formed. The same arguments recited above apply to the rejection of these claims. At the time the invention was made, it was not obvious to replace a plurality of high power bimorph transducers with a polymer film transducer having less power. As in the previous rejection, the Tibbetts and Tanaka references teach away from each other, with Tanaka disclosing the use of a plurality of high power bimorph transducers to produce parametric sound, and Tibbetts disclosing a lower power film transducer. It would not have been obvious to one skilled in the art to go against the teachings of the time, using a plurality of high power bimorph transducers, as disclosed in Tanaka, and instead use a lower power film transducer as disclosed in Tibbetts.

Therefore, Applicant respectfully submits that claims 4, 7, 8, 16, 17, 25, 31, 39, 40, 46, 48, 49 and 51 are allowable, and urges the Examiner to withdraw the rejection.

CONCLUSION

In light of the above, Applicant respectfully submits that pending claims 1-4, 7, 8, 11, 12, 16, 17, 19-22, 24-31, 34, 35, 39, 40, 43-49, 51, 79, 82, 83, 85, 86, 91-93 are now in condition for allowance. Therefore, Applicant requests that the rejections and objections be withdrawn, and that the claims be allowed and passed to issue. If any impediment to the allowance of these claims remains after entry of this Amendment, the Examiner is strongly encouraged to call Alex W. Haymond at (801) 566-6633 so that such matters may be resolved as expeditiously as possible.

No claims were added. Therefore, no additional fee is due.

The Commissioner is hereby authorized to charge any additional fee or to credit any overpayment in connection with this Amendment to Deposit Account No. 20-0100.

DATED this 27th day of June, 2007.

Respectfully submitted,

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